* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]In the SUINNGU power supply of a multi-output with a main output circuit and **********, this invention relates to the composition of **********. When it explains in full detail, this ********** is starting appropriately the pulse width of the pulse form voltage applied to the circuit concerned, and is a thing of a method which obtains the dc output voltage of a desired value.
[0002]
[Description of the Prior Art]The figure showing the switching power supply of the conventional multi-output for which drawing 5 prepared a main output circuit and **********, and drawing 6 are the figures showing the waveform of each part of drawing 5. A main output circuit is an output circuit which provides the voltage V1 which becomes a basis of the signal S1 which controls the main switch Q1 by the side of [the transformer T] primary. The control circuit 3 outputs the pulse width signal S1 whose output voltage V1 of the main output circuit 1 corresponds with a programmed voltage (not shown), and controls the duty of the switch Q1 here. As a result, the duty of the voltage V0 induced by secondary coil W3 changes, as for rectification and smoothness, this is carried out, and the main output voltage V1 of a circuit turns into a programmed voltage. The main output circuit 1 comprises the diode D2 which releases secondary coil W3, the diode D1 which rectifies this induced voltage, the choke coil L1 and the smoothing circuit which comprises the capacitor C1, and the energy stored in the choke coil L1. It is insulated with the photocoupler 2 and the output voltage V1 of the main output circuit 1 returns to a primary the transformer T side.
[0003]With **********, it is a thing of a circuit which is connected to the secondary coil W2 looped around apart from coil W3 of a main output circuit, and obtains direct current voltage from the induced voltage of this coil W2. Since the duty of the voltage V0 induced by the coil

W2 of ********** changes with input voltage V_{in} or load current I_{OUT} of a main output circuit, if it is not coped with, the dc output voltage V2 of ********** 10 will be changed. Then, ********** 10 is provided with a means to stabilize ********** V2 generally. In drawing 5, the waveform generating circuit 6 mentioned later, the control circuit 5, and the drive circuit 4 are the stabilization means of ********** V2. in drawing 5, it is rectified by the diode D3 and the induced voltage V0 (refer to drawing 6 (1)) of the coil W2 is a switch element -- it comes out and is added to certain FET Q2. FET Q2, the turning on and off is controlled by the drive circuit 4. Smoothness of the voltage which passed the switch element Q2 is carried out by the choke coil L2 and the capacitor C2, and it turns into small ********** V2 of a ripple. The diode D4 releases the energy stored in the choke coil L2 to the period of OFF of the switch element Q2.

[0004]The pulse width Tp (refer to drawing 6 (1)) of the induced voltage Vo of the coil W2 is appropriately started by the switch element Q2, and stabilization of this ********** V2 is performed by adding this to the smoothing circuit (the choke coil L2 and the capacitor C2) of the next step. The control action of the switch element Q2 is explained referring to drawing 6. This ********** V2 is stabilized by the control circuit 5 which introduces the waveform generating circuit 6 which outputs a synchronization voltage form as introduced the voltage Vo of the coil W2 and shown in drawing 6 (3), and this ********** V2 and the output Vc of the waveform generating circuit 6, and controls the drive circuit 4 like drawing 6 (2). Carrying out switching of FET connected to the control circuit 3, the transformer T2 carries out level conversion of the output of the control circuit 5.

[0005]The device of such drawing 5 operates as follows. Direct-current-voltage V_{in} has occurred in the both ends of the capacitor C3. On-off control of the switch element Q1 is carried out by the control circuit 3. Therefore, since voltage is intermittently applied to the primary coil W1, induced voltage occurs in the secondary coil W2 and W3. Here, the main output voltage V1 obtained in the main output circuit 1 returns to a primary the transformer T side via the photocoupler 2. And the pulse width modulation signal S1 is made in the control circuit 3 so that this main output voltage V1 may turn into a programmed voltage (not shown), and based on this, the duty of turning on and off of the main switch element Q1 is controlled.

[0006]Here, the duty of the voltage Vo induced by this secondary coil W2 is changed by input voltage V_{in} or load current I_{out} by the side of a main output circuit. The reason is as follows. If input voltage V_{in} falls, in order to keep the main output voltage V1 constant, the duty of the main switch Q1 increases. If load current I_{out} of the main output circuit 1 increases, in order to keep the main output voltage V1 constant, the duty of the main switch Q1 increases. Therefore, the duty of the induced voltage Vo of the coil W2 looped around the same core as coil W3 also increases. Thus, even if it changes the duty of the induced voltage Vo of the coil W2, the control action of the device of drawing 5 is carried out so that ********** V2 may

become fixed. The control action is explained. The input voltage Vo applied to ********** 10 as mentioned already is a waveform like drawing 6 (1). The waveform generating circuit 6 introduces this input voltage Vo, and outputs the synchronization voltage form (refer to drawing 6 (3)) with which the input voltage Vo increases only the period Tp of HIGH (refer to drawing 6) and in the shape of a ramp wave (the shape of a saw tooth wave). This synchronization voltage form is a signal in sync with the switching waveform by the side of [the transformer T] primary, and the waveform generating circuit 6 detects the one side (HIGH) of the induced voltage Vo of the secondary coil W2, and is making this waveform. The control circuit 5 introduces the synchronization voltage form of this drawing 6 (3), and ********** V2, and makes the comparison voltage VK to that inside.

[0007]This comparison voltage VK (refer to drawing 6 (3)) that the control circuit 5 makes rises, when ********** V2 of ********** 10 is higher than a programmed voltage (not shown). The comparison voltage VK which made the control circuit 5 itself, and drawing 6 A synchronization voltage form is compared and the signal [like] with which the switch element Q2 serves as one (refer to drawing 6 (2)) is added to the drive circuit 4 during the comparison voltage VK < synchronization voltage type value. If it explains concretely, when ********** V2 is higher than a programmed voltage, the comparison voltage VK of drawing 6 (3) will rise. Therefore, comparison voltage VK< synchronization voltage type value The becoming period, i.e., the period when the switch element Q2 serves as one, decreases. As a result, since quantity of electricity supplied to the smoothing circuit which comprises the choke coil L2 and the capacitor C2 decreases, the value of ********** V2 decreases and approaches a programmed voltage. On the contrary, when ********** V2 is lower than a programmed voltage, the comparison voltage VK falls and becomes above-mentioned operation and reverse. That is, the period when the switch element Q2 serves as one spreads, and since quantity of electricity supplied to the choke coil L2 and the capacitor C2 increases, ********** V2 increases. That is, ********** V2 approaches a programmed voltage.

[0008]

[Problem(s) to be Solved by the Invention]Although MOS-FET is generally used as the switch element Q2, MOS-FET cannot be driven to one here, unless more than 4v makes gate voltage higher than source voltage at least (a still more general junction type FET must also make gate potential higher than source potential). That is, more than 4v needs to apply a high voltage signal to the gate of FET Q2 rather than the A point of drawing 5. However, an A point is a plus side potential point of ********** 10, and an insulating means is required for it in order to obtain high potential more. Then, conventionally, with the device, it has the drive transformer T2 and the output of the control circuit 5 is applied to this, and from the A point, more than 4V makes high voltage, and it is adding to the gate of FET Q2.

[0009]If the drive transformer T2 is formed between the control circuit 5 and the drive circuit 4

here, when passing this drive transformer T2, delay of the pulse width signal Va arises. When this time delay is set to Td, generally it is as Td=200 ns. Therefore, it is a comparison voltage VK< synchronization voltage type value at a certain time TA. Even if it becomes, before the control circuit 5 detects this and actually makes the switch element Q2 one, time Td will start (refer to drawing 6 (2)). Therefore, only the greatest (Tp-Td) pulse width can be supplied to a smoothing circuit (circuit which comprises L2 and C2) via the switch element Q2 to the input pulse width Tp (it is also the output pulse width of the transformer T) applied to ********** 10. Since it is Td=200 ns << Tp=3 mus here if the switching frequency of the power supply of drawing 5 is frequency with a low 100 KHz grade (input PARUZU width Tp, about 3 mus), the time delay Td shown in drawing 6 (3) is like [which can be disregarded]. However, since the shape and the circuit element of a transformer become large, the switching power supply of a low frequency wave designs switching frequency increasingly by high frequency for a miniaturization.

[0010]Since the input pulse width Tp becomes small, the rate that the time delay Td occupies becomes large, and it becomes impossible however, to disregard the time delay Td in the switching power supply of high frequency. If it states concretely, the rate that the time delay Td occupies [the switching frequency to which the input pulse width Tp becomes comparatively large compared with the time delay Tp] by not less than 300-kHz high frequency (Tp<1 mus) will become large. Therefore, since there is little quantity of electricity supplied to a smoothing circuit when it is going to output a high current from **********, there is a problem of it becoming impossible to secure an output. When the synchronized signal Vc is made in response to the output Vo of the coil W2 of the transformer T, the parts (parts with large shape) of high withstand pressure are needed. Since circuit GA connection is made and parasitic capacitance increases to the output of a transformer, there is also a problem referred to as that a primary side is affected by not less than 300-kHz high frequency.

[0011]The purpose of this invention can secure an output also in the time of a high current output by canceling delay of the drive signal Va by the drive transformer T2, It is providing the switching power supply which can use the electronic parts of low pressure-proofing by taking the signal of the basis which makes the synchronized signal Vc from circuits other than the transformer T.

[0012]

[Means for Solving the Problem]This invention switches a main switch (Q1) formed in a primary a transformer (T) side, Smoothness of the rectification waveform of voltage induced by the 1st coil (W3) of a secondary is carried out with a choke coil (L1), In switching power supply which controls duty of switching so that obtained main output voltage (V1) becomes equal to the 1st programmed voltage (Vt), It is provided between the 2nd coil (W2) provided in a secondary of said transformer, a smoothing circuit which carries out smoothness of the

rectification waveform of an output of this 2nd coil, and this 2nd coil and a smoothing circuit, and by carrying out an on-off action. FET (Q2) which controls quantity of electricity to pass, and the 3rd coil (W6) looped around an iron core of said choke coil (L1), Auxiliary power which carries out rectification smoothness of the voltage induced to this 3rd coil, makes direct current voltage, and connects outgoing end of one of these to the sauce side of said FET, Direct current voltage obtained by this auxiliary power is used as a power supply, and it has a PWM circuit which adds a pulse signal (Ve) of duty that the 2nd programmed voltage (Vs) and ********** (V2) of said smoothing circuit become equal to FET, and carries out the on-off drive of this.

[0013]

[Function]It is necessary to add the signal of potential higher than source potential for driving FET at a gate. The 3rd coil of this invention was looped around the iron core of the choke coil, and one outgoing end of auxiliary power is connected to the sauce side of FET. This choke coil makes main output voltage, and is a component by the side of a main output circuit. Therefore, the fixed direct current voltage Vcc is obtained from auxiliary power only by carrying out rectification smoothness of the induced voltage of this choke coil. And this direct current voltage Vcc can be made into voltage sufficient by defining the number of turns of the 3rd coil appropriately to drive FET. Therefore, since the PWM circuit can drive FET directly with the output Ve, it is wide opened from delay of the signal in the drive transformer T2 (that with which the means was provided conventionally).

[0014]

[Example]The time chart and drawing 4 the figure and drawing 2 in which the example of composition of the switching power supply which drawing 1 requires for this invention is shown explain the time chart of the signal of each part of drawing 1, and drawing 3 explains operation of whole drawing 1 to be are a figure showing another example of composition of ********. In drawing 1, the main switch Q1 by the side of [the transformer T] primary is switched by the pulse width signal S1 added from PWM circuit 23. This switching frequency is defined by the oscillating circuit 21. The pulse form voltage induced by coil W3 of the secondary turns into the main output voltage V1 by operation of the diode D1 of a main output circuit, the choke coil L1, and the capacitor C1. And this voltage V1 is applied to the error amplifier 24, and is compared with the programmed voltage Vt here. The error amplifier 24 returns comparison signal Vk' to PWM circuit 23. If comparison signal Vk' is the programmed-voltage Vt < main output voltage V1, the value will increase it, and if reverse, the value will decrease. And it will be set to a certain voltage level if it is Vt=V1. Since PWM circuit 23 controls the duty of the pulse signal S1 outputted based on introduced comparison signal Vk', the main output voltage V1 becomes a value equal to the programmed voltage Vt. The auxiliary power 22 makes direct current voltage from the induced voltage of the coil W4 looped around the iron core of the transformer

T, and supplies the power supply voltage of PWM circuit 23.

[0015]Next, ********** is explained. In drawing 1, the diodes D3 and D4, FETQ2, the choke coil L2, and the capacitor C2 have the same operation and effect as what was explained by drawing 5. That is, the diode D3 has the operation which rectifies the voltage induced to the coil W2, and the choke coil L2 and the capacitor C2 constitute the smoothing circuit. With the coil W2, FETQ2 is provided between said smoothing circuits, is carrying out an on-off action, and controls quantity of electricity to pass.

[0016]This invention has the feature in the composition after this. The coil W6 is looped around the iron core of the choke coil L1 which constitutes the main output circuit 1, and the end is connected at the A point by the side of the sauce of FETQ2. And it is looped around flyback connecting relation (refer to a choke coil L1 copy dot) as it is indicated in drawing 1 as the coil W5 of the basis of the choke coil L1, and this newly looped-around coil W6. The waveform generating circuit 11 introduces induced voltage VB of this coil W6, and it outputs synchronization voltage form Vc of a saw form which changes on a fixed inclination repeatedly until it is turned off [next] from the time of the main switch Q1 serving as OFF. The point which has made the timing signal of the basis with which the waveform generating circuit 11 of this application makes the synchronized signal Vc from induced voltage VB of the coil W6 looped around the choke coil L1 of the main output circuit 1, It differs from the waveform generating circuit of the conventional example in [which changes on a fixed inclination repeatedly] that it is a saw form until the shape of the synchronized signal Vc is turned off [next] from the time of the main switch Q1 serving as OFF.

[0017]The error amplifier 14 introduces ********** V2 and the programmed voltage Vs of a smoothing circuit (********** 10), and outputs the comparison signal Vk. This error amplifier 14 performs the same operation as the error amplifier 24 mentioned already.

A thing also with the completely same composition can be used.

That is, ********** V2 is applied to the error amplifier 14, and is compared with the programmed voltage Vs here. And the error amplifier 14 outputs the comparison signal Vk to PWM circuit 13. If the comparison signal Vk is programmed-voltage Vs < ********** V2, the value will increase it, and if reverse, the value will decrease. And it will be set to a certain voltage level if it is Vs=V2.

[0018]The auxiliary power 12 carries out rectification smoothness of the pulse form voltage VB induced to the coil W6, and obtains the direct current voltage Vcc. Although this auxiliary power 12 can be constituted from the diode D5 and the capacitor C4, Since the main output circuit 1 is already controlled by PWM circuit 23 by fixed voltage, it is the voltage by which rectification and the direct current voltage Vcc which only carries out smoothness and was obtained were only stabilized by the diode D5 and the capacitor C4 in voltage VB induced to the coil W6. and -- the obtained direct current voltage Vcc receives at an A point -- Vcc -- it is

high voltage. PWM circuit 13 uses as a power supply direct current voltage Vcc obtained by the auxiliary power 12, and The waveform generating circuit 11 to synchronization voltage form Vc, The comparison signal Vk is introduced from the error amplifier 14, the signal Ve acquired by comparing the size of this signal is directly added to the gate of FETQ2, and the on-off drive of this is carried out.

[0019]Operation of the device of drawing 1 constituted as mentioned above is explained with reference to drawing 2. The point by which it is characterized [of this invention / 1st] is a point of newly forming the coil W6 in the choke coil L1 of the main output circuit 1, and having obtained the direct current voltage Vcc higher than an A point from this coil W6 to it. The point by which it is characterized [2nd] is a point which has made the timing signal of the basis which makes the synchronized signal Vc from induced voltage VB of the coil W6 looped around the choke coil L1 of the main output circuit 1. Many effects are acquired with constituting in this way.

[0020]The waveform of voltage VA as shown in drawing 2 (1) is induced by the coil W5 of the choke coil L1. Here, the time t1-t2, and t3-t4 are the periods of one of the main switch Q1. The time t2-t3 is a period of OFF of the main switch Q1.

The coils W5 and W6 serve as flyback connection, and since the main output voltage V1 is stabilized if induced voltage VB (refer to drawing 2 (2)) of the coil W6 is made rectification and smooth, the stable floating voltage Vcc (for example, 15V) is obtained from the auxiliary power 12. Since flyback connection is made, the auxiliary power 12 operates in the period when the choke coil L1 is operating as OFF about the main output circuit 1 so that electric power may be incorporated (refer to drawing 2 (2)). That is, even if it connects the auxiliary power 12, the stability of the main output voltage V1 is not affected. since one side of the output terminal of the auxiliary power 12 is connected at the A point shown in drawing 1 -- the auxiliary power 12 -- an A point -- Vcc -- PWM circuit 13 can be supplied by making high voltage into power supply voltage. therefore, PWM circuit 13 -- an A point -- the abbreviation Vcc -- since high voltage can be applied to the gate of FETQ2, direct FETQ2 can be driven via the transformer for a drive (refer to drawing 5).

[0021]Next, operation of the waveform generating circuit 11 and PWM circuit 13 is explained. Pulse shape VB shown in drawing 2 (2) is added to the waveform generating circuit 11. Since this pulse shape VB is expressing turning on and off of the main switch Q1, the waveform generating circuit 11 can grasp the time of being turned off [next] from the time of the main switch Q1 serving as OFF by recognizing the rising edge of waveform VB. And as shown in drawing 2 (3), saw form Vc which changes on a fixed inclination repeatedly in this period is outputted. PWM circuit 13 adds the signal Ve of pulse width as compared the size of synchronization voltage form Vc with the comparison voltage Vk which changes as mentioned already and shown in drawing 2 (4) as a result to FETQ2, and is driving this to turning on and

off. Thus, since the timing signal (signal meaning turning on and off of the main switch Q1) of the origin which makes synchronization voltage form Vc was not adopted from the transformer T in this invention but it has introduced from the choke coil L1 of the main output circuit 1, The effect which does not need the parts of high withstand pressure as electronic parts which constitute the waveform generating circuit 11 is also acquired.

[0022]Next, operation of the whole drawing 1 device is explained with reference to drawing 3. The operation start of the device of drawing 1 is as following. In PWM circuit 23 operating first, if the main output voltage V1 rises like drawing 3 (1), along with this, the output voltage Vcc of the auxiliary power 12 will also rise (refer to drawing 3 (2)). And if the voltage Vcc reaches to voltage VM of PWM circuit 13 which can be operated, PWM circuit 13 will start the operation mentioned already (start shown in drawing 3 (3)), and ********** V2 will rise. Next, it is as following that the device of drawing 1 suspends operation. Since the main output voltage V1 will decrease if PWM circuit 23 suspends operation, ********** Vcc of the auxiliary power 12 also declines. And if the voltage Vcc falls to operating limit voltage VM' of PWM circuit 13, PWM circuit 13 will suspend the operation (refer to drawing 3 (3)). Thus, according to this invention, operation with the main output circuit 1 and ********** 10 is made to cooperate, and can be driven. Input voltage can be supervised by seeing the voltage of the choke coil L1 of the main output circuit 1.

[0023]Drawing 4 is a figure showing another example of composition of the diodes D3 and FETQ2 with the choke coil L2 in ********** 10 of this invention device, and the capacitor C2. Since it comprises floating, the drive circuit of FETQ2 may constitute arbitrarily the choke coil L2, the capacitor C2, and the locating position of the diodes D3 and FETQ2 from this invention like drawing 4. Although what is called primary side control methods that have arranged PWM circuit 23 to the primary the transformer T side explained in ****, this invention is materialized also with what is called a secondary control system that arranges this PWM circuit 23 to the secondary of the transformer T. In this case, it is insulated, for example by a transformer and the output S1 of PWM circuit 23 is applied to the main switch Q1.

[0024]

[Effect of the Invention]As explained above, according to this invention, since the drive transformer T2 (refer to drawing 5) became unnecessary, the delay of the signal Ve which drives FETQ2 was canceled. Therefore, even if it constitutes switching power supply from a circuit of high frequency, a high current can be taken out from **********. Since it stopped needing the drive transformer T2, saying that the noise of high frequency flows into a primary the transformer T side was lost. Since the signal of the basis which makes the synchronized signal Vc is taken from circuits (choke coil L1) other than the transformer T, the waveform generating circuit 11 can be constituted from electronic parts of low pressure-proofing, and, as a result, switching power supply can be miniaturized.

[Translation done.]

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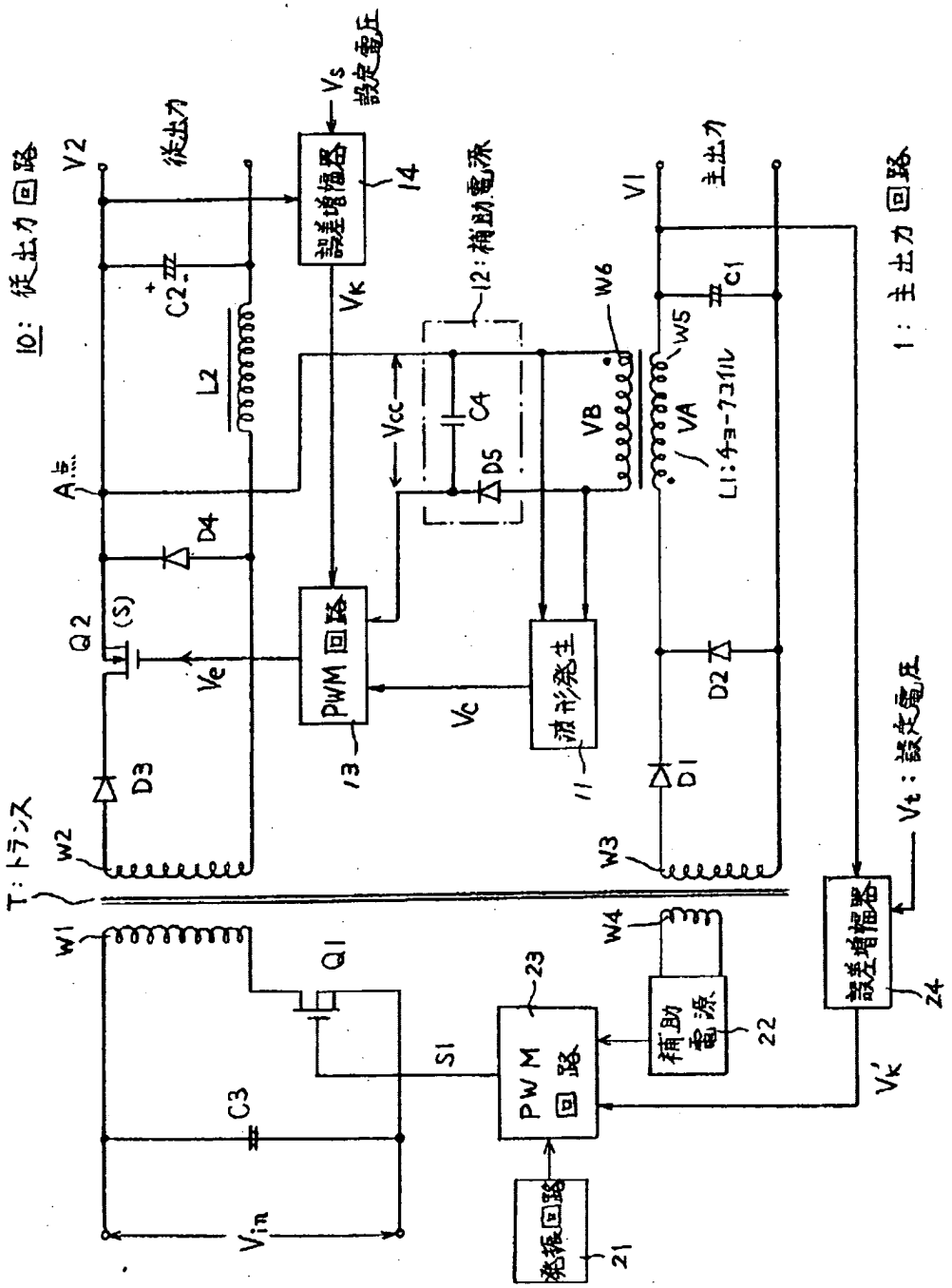
DRAWINGS

[Drawing 1]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V2
従出力
Vs
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誤差増幅器
14
C2
L2
Vk
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W6
V1
主出力
C1
W5
1: 主出力回路
A点
Vcc
C4
D5
VB
VA
L1: 4ターン
D4
Q2
(S)
Ve
PWM回路
Vc
波形発生
D2
D3
13
11
D1
T: トランス
W2
W3
Vt: 設定電圧
W1
W4
Q1
23
誤差増幅器
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Vk'
Vin
発振回路
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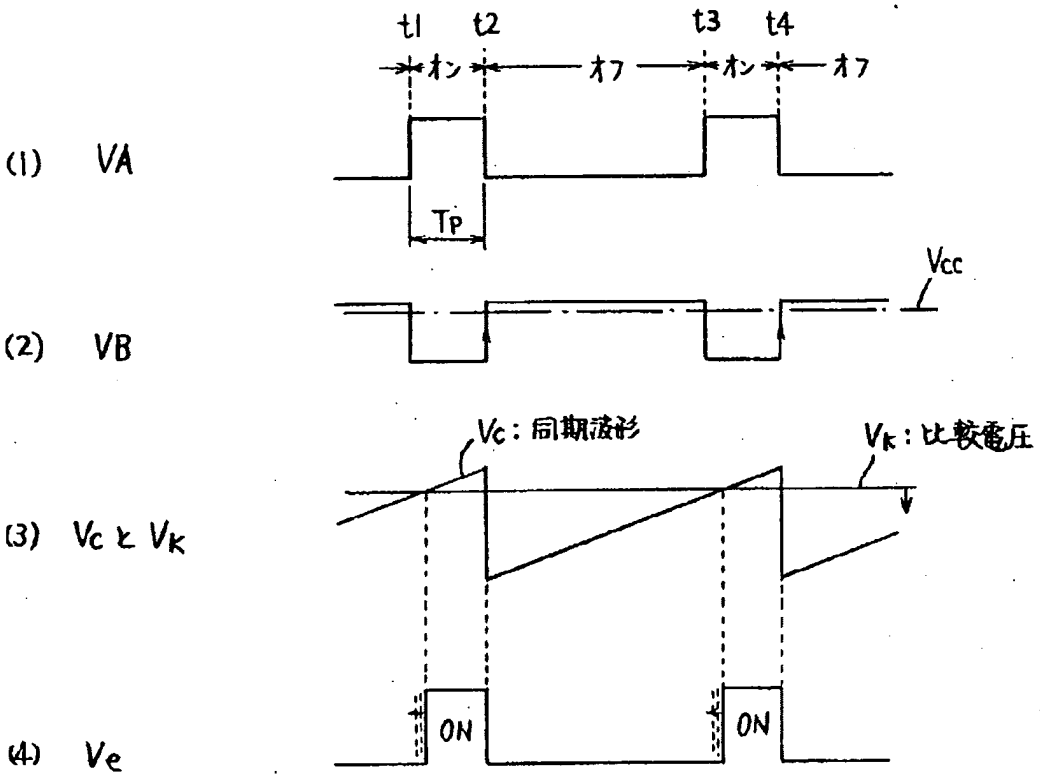
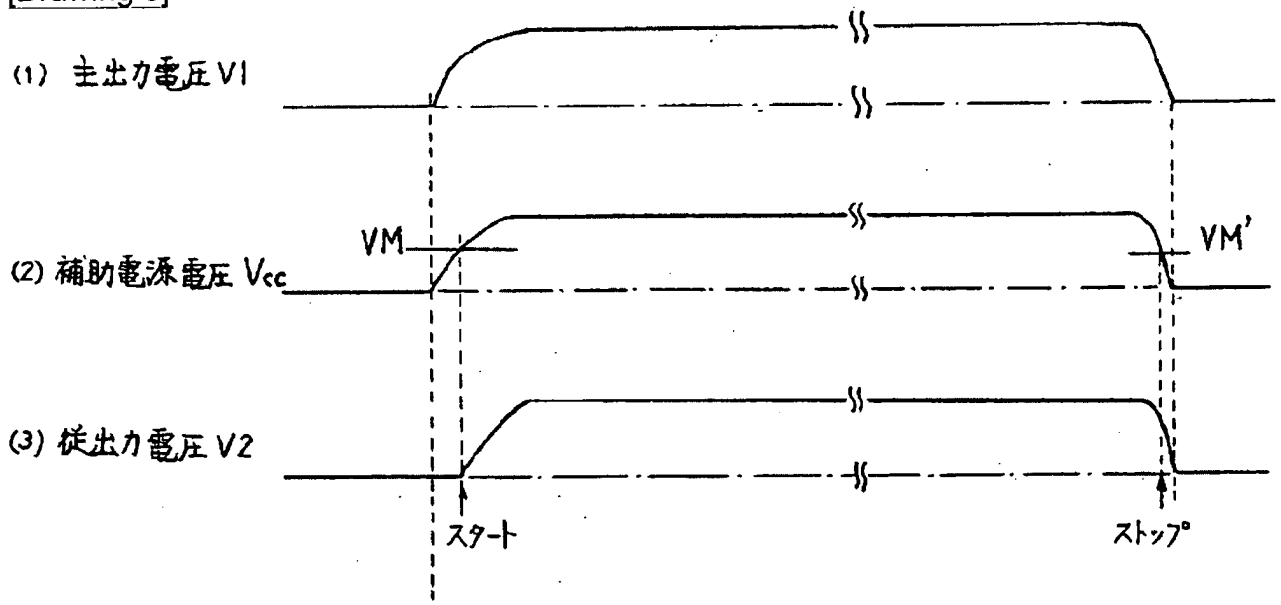
[Drawing 2]



[Drawing 3]



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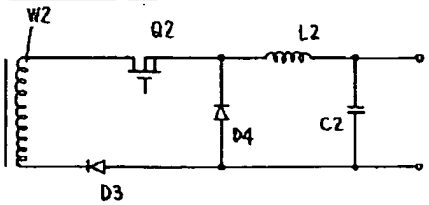
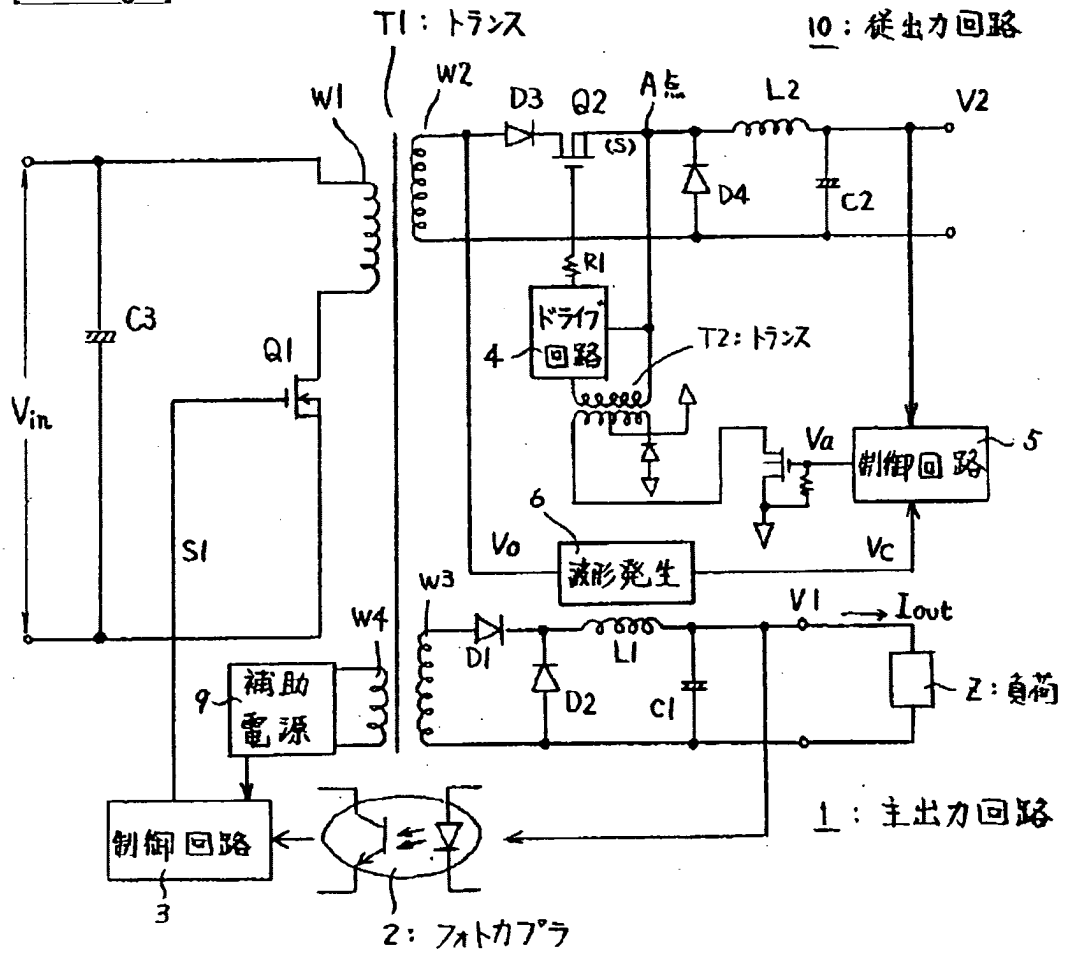
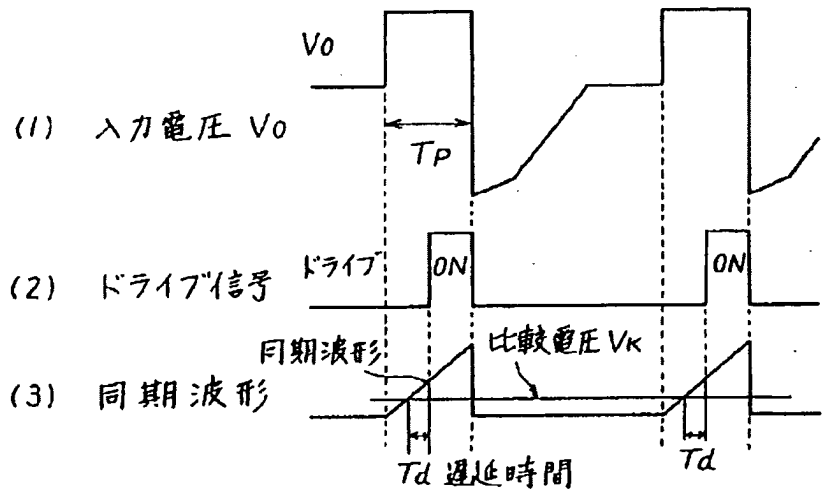


[Drawing 5]



[Drawing 6]



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